



Contribution ID: 324

Type: Talk

【156】 Field-induced bound-state condensation and spin-nematic phase in $\text{SrCu}_2(\text{BO}_3)_2$ revealed by neutron scattering up to 25.9 T

Thursday 7 September 2023 18:15 (15 minutes)

High-field Inelastic Neutron Scattering experiments have been conducted on $\text{SrCu}_2(\text{BO}_3)_2$ up to 25.9T and we find a rich set of excitations whose energies and spectral intensities have been measured as a function of magnetic field. Using cylinder matrix-product-states calculations on the Shastry-Sutherland model with Dzyaloshinskii–Moriya interactions, we reproduce experimental spectra. Multiple unconventional spectral features such as the gradients of the one-triplet branches and the persistence of the single-triplet gap point to a condensation of spin-2 bound states, thus realizing a spin-nematic phase. The single-triplet gap reflects a direct analogy with superconductivity, suggesting that the spin-nematic phase in $\text{SrCu}_2(\text{BO}_3)_2$ is best understood as a condensate of Cooper pairs of hardcore bosons.

Theoretical Work

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Session Classification: Condensed Matter Physics (KOND)

Track Classification: Condensed Matter Physics (KOND)